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Biodiversity and Protected Areas in Turkey

(Kepelbagaian dan Kawasan Perlindungan di Turki)

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ABSTRACT

Turkey has three major bio-geographical regions namely Euro–Siberian, Mediterranean and Irano-Turanian. There are very different types of ecosystems such as agricultural, mountain, forests, steppes and wetlands, as well as coastal and marine. The country has rich floral and faunal diversity, high endemism and wide genetic diversity. A good progress has been made in protecting nature and biodiversity rich areas. Since 1990, the extent of protected areas has almost doubled to reach 7.2% of the territory. There are 40 national parks, 31 nature conservation areas, 107 natural monuments, 184 nature parks, 81 wildlife reserve areas, 58 conservation forests, 239 genetic conservation areas, 373 seed stands, 15 specially protected areas, 1273 natural sites, 14 Ramsar sites and 1 biosphere reserve. In this paper information on different ecosystems of the country is presented.

Keywords: Biodiversity; ecosystems; protected areas; Turkey

ABSTRAK

Turki mempunyai tiga wilayah biogeografi utama iaitu Euro–Siberia, Mediterranean dan Irano-Turania. Terdapat jenis ekosistem berbeza seperti pertanian, gunung, hutan, steppe dan tanah bencah, juga persisiran pantai dan samudera. Negara ini mempunyai kepelbagaian flora dan fauna yang kaya, endemisme tinggi dan kepelbagaian genetik yang luas. Suatu kemajuan telah dilaksanakan dalam melindungi alam semula jadi dan kawasan kaya dengan kepelbagaian biologi. Semenjak 1990, kewujudan kawasan dilindungi telah berganda dan mencapai 7.2% daripada jumlah keluasan negara. Terdapat 40 taman negara, 31 kawasan pemuliharaan semula jadi, 107 tugu alam, 184 taman alam, 81 kawasan simpanan hidupan liar, 58 hutan pemuliharaan, 239 kawasan pemuliharaan genetik, 373 dirian biji benih, 15 kawasan perlindungan khusus, 1273 tapak alam, 14 tapak Ramsar dan 1 simpanan biosfera. Dalam kertas ini maklumat mengenai ekosistem berbeza negara akan diberikan.

Kata kunci: Ekosistem; kawasan perlindungan; kepelbagaian biologi; Turki

INTRODUCTION

Millennium Development Goals (MDG) were announced by the world leaders in 2000 and 'ensuring of environmental sustainability' was one of the goals. There were four targets to realize this goal and 'reducing biodiversity loss by 2010' was one of the targets. According to the MDG Report for 2010, the world has missed the 2010 target for biodiversity conservation and the loss of biodiversity continues. Nearly 17000 species of plants and animals are known to be threatened with extinction in the world and the major drivers of biodiversity loss are not being sufficiently addressed yet.

The main threats to biodiversity loss are degradation of habitats, invasive species, over-exploitation of natural resources, pollution and climate change. Major drivers of biodiversity loss are not being sufficiently addressed yet. The IUCN red list of threatened species and the MEA state that there are some declines in all biomes and taxa and these declines are very serious in islands, dry forests, Polar Regions and marine environments. MEA reports that 60% of ecosystem services are degraded and 30% of species globally are under threat due to climate change.

According to the report prepared by European Environment Agency (EEA) in 2009, European biodiversity is going to be under serious pressures and threats. Although some policies which try to halt biodiversity loss are successful in some areas, it is not enough to stop the declines in general. In order to reduce pressures and threats some progress has been achieved through specific legislation on atmospheric emissions, freshwater quality and waste water treatment. Problems and pressures caused by agricultural sector have been solved through reducing nitrogen losses and increasing organic farming. The climate change impact on biodiversity loss is an emerging subject, but the wider ecosystem implications have not been fully recognized yet.

Some floral and faunal species are also declining in Turkey because of pressures such as urbanization, industrialization, tourism and environmental degradation. The main threats to biodiversity are illegal hunting, uncontrolled tourism activities, over grazing, pollution of rivers and lakes, illegal cutting of forest, illegal plant collections and land degradation.

OECD Report on Environmental Performance Review of Turkey states that more than 20% of mammals (22 species) are threatened (vulnerable and endangered according to IUCN categories). A number of terrestrial mammal species (red and brown deer, wild mouflon, gazelle and otter) are also decreasing and considered to be in danger of extinction. The Anatolian leopard was thought to be extinct, but traces of its existence have been found. The Mediterranean monk seal (*Monachus monachus*), along with the loggerhead sea turtle (*Caretta caretta*) and green sea turtle (*Chelonia mydas*), which were under endangered category for many years, are among the world's 12 most threatened species, face to face with extinction. The numbers of dolphins and whales is decreasing rapidly. Many threatened bird species of Europe breed in Turkey (flamingo and white-headed duck). Tuz Golu (Tuz Lake) is Turkey's largest nesting site for flamingo, with colonies of 5000 to 6000 nests (OECD 1999). About 100000 flamingos nest in Turkey. Some 20% of the world's population of white-headed ducks hibernates at Lake Burdur (Kiziroglu 2006).

Materials and Methods

This paper was prepared with the information provided by the Ministry of Forestry and Water Affairs, which is responsible for the protection and sustainable management of biodiversity and natural resources in Turkey. There are many documents indicating flora, fauna and ecosystem and habitat characteristics of the country. One of the documents is the National Biodiversity Strategy and Action Plan (NBSAP) which has served as the main background for this paper. The NBSAP includes flora and fauna, genetic and ecosystem diversities of Turkey. The strategy has been prepared by the ministry's staff.

Other document is the OECD Environmental Performance Reviews of Turkey. This study includes data and information from the OECD Report. This report was prepared by the gathering data and information taken from some institutions which are researching the environmental and agricultural subjects in the country. Some information regarding the protected areas was taken from general directorates of the ministry. The General Directorate of Nature Conservation and National Parks and the General Directorate of Forestry are the main bodies of the ministry to protect and manage biodiversity and protected areas. Their duty is to obtain international information and data about threats and pressures to biodiversity conservation and successful developments and also declines in biodiversity conservation. Many reports and documents were reviewed and the required information were used in this paper.

Results

Floral and Faunal Diversity

Turkey is a country situated on the continents of Asia and Europe, bounded on the north by the Black Sea, on the west by the Aegean Sea and on the south by the Mediterranean. Turkey has three major bio-geographical regions namely Euro–Siberian, Mediterranean and Irano-Turanian, with a total surface area of 780 576 km^2 (Figure 1). There are very different types of ecosystems such as coastal and marine, agricultural, mountain, forests, steppes and wetlands. The flora and fauna are very rich with a high endemism and wider genetic diversity.

There are more than 90000 species including flora and fauna. These cover approximately 9500 vascular plants, 4000 lower plants, 60 to 80000 invertebrates and 1400 vertebrates. Out of 9500 vascular plant species,

FIGURE 1. Location map of Turkey

approximately one-third are endemics and three-quarters of all plant species existing in Europe grow in Turkey (Figures 2, 3, 4, 5, 8). The country is accepted as the richest especially in vascular plant species, within its climate zone. Among the phytogeographic regions, the Irano-Turanian region has the greatest number of endemic species followed by the Mediterranean and Euro-Siberian regions.

FIGURE 2. *Tadorna ferruginea* (*Aykut İnce)*

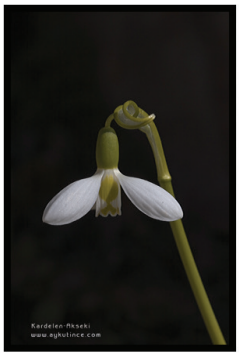

FIGURE 3. *Galanthus nivalis (Aykut İnce)*

FIGURE 4. *Circaetus gallicus (Aykut İnce)*

FIGURE 5. *Capreolus capreolus* (*Aykut İnce*)

TABLE 1. Distribution of endemic plant species among the phytogeographical regions

Phyto-geographical regions	Number of endemic plant species
Euro-Siberian	320
Mediterranean	1325
Irano-Turanian	1250
Non-specific to particular phytogeographical region	1030
Total	3925

Inspite of this rich endemism, some of these species are facing serious threats. According to the IUCN 2001 red list assessment, about 600 of total endemic species are in the category of 'Critically Endangered –CR' and about 700 species in the category of 'Endangered –EN'.

Considering the zone in which it is located, Turkey is rich and interesting in fauna as well. Anatolia forms a bridge between the continents of Europe and Asia and is therefore located on migration routes. Consequently many animal species can be found here as their best habitats exist in the country. All the diverse ecological factors are reflected in the faunal diversity. Many studies showed that 460 bird species, 161 mammal species, 141 reptile species, 480 sea fish species and 236 fresh water fish species can be found in Turkey.

Although some of the habitats have been degraded or even damaged, they provide shelter for endangered species such as the Mediterranean seal (*Monachus monachus*) (Figure 6), the sea turtle *(Caretta caretta)* (Figure 7) and the green sea turtle (*Chelonia mydas*).

FIGURE 6. *Monachus monachus (Cem Kıraç)*

FIGURE 7. *Caretta caretta (İrfan Ekmekçi-Prof. Dr. Yakup Kaska)*

In all 16 of the 141 reptiles and amphibian species distributed in Turkey are endemic and 10 endangered. There are no endemic species of birds in the country. However, 5 mammal species and 32 sub-species and 70 fresh water bird species and sub-species are endemic.

GENETIC DIVERSITY

Turkey has a tremendous plant genetic resource. There are 5 micro-gene centers where more than 100 species display a broad variation. It is the origin or diversity center of many important cultivated plants and other plant species. Some of the cultivated plant species are *Triticum, Hordeum, Secale, Avena, Linum, Allium, Cicer, Lens, Pisum, Medicago* and *Vicia*.

The total number of cereal types developed through the use of local and imported breeds and recorded during the last thirty years in Turkey are 256, of which 95 are wheat types, 91 corn, 22 barley, 22 rice, 16 sweet sorghum, 11oat and 2 rye. The richness of variety is also noticeable in fruit production. Of the fruit types estimated in general 80 are grown in Turkey. The country is also quite rich in forest gene resources, including the valuable gene resources of the Taurus cedar, the oriental spruce and the oriental beech together with 5 pines, 4 firs, 20 oaks and 8 junipers species among the local forest trees of national and global importance.

ECOSYSTEM DIVERSITY

The ecosystems found in Turkey are:

Agricultural Ecosystems The cultivated areas constitute about 35% of Turkey's total surface area. Seventy percent of this figure is formed by cropland, 5% by orchards, 2.7% by vegetable gardens, 2% by vine yards and 2% by olive groves. The remaining area (18%) is left fallow according to the cultivation pattern. Grasslands and meadows constitute about 19% of the total area. The coastal meadows include grazing areas and about 25-30% of the country's meadows are coastal meadows, but steppe meadows are divided into two 'mountain steppe meadows' and 'plain steppe meadows'.

Steppe Ecosystems The steppe formation is divided into two; 'plain steppe' and 'mountain steppe'. Former provides a habitat for species such as halophilic plants, members of the chenopodiaceae, juncaceae and cyperaceae, harmal, speedwell, thyme and garden sage; latter hosts the species of astragal, thorny sainfoin, globe thistle, asphodel and thyme.

Forest Ecosystems The forest area in the country covers 21.4 million ha, which is 27% of the national territory. Out of this 51% is productive and 49% is unproductive. The forest types according to the bio-geographical regions are:

Euro-Siberian bio-geographical region: broad-level and coniferous forests (beech, chestnut, hornbeam); humid and semi-humid coniferous forests (black pine, Scotch pine, spruce, fir) (Figure 9); dry oak and pine forests (oak, black pine, red pine); Shrub (maquis and pseudo-maquis, red pine). Mediterranean bio-geographical region: Shrub (maquis and garigue, oaks, Sandal, gum, myrtle); Low-altitude Mediterranean belt forests (red pine, black pine); Aegean high mountain forests (chestnut, beech, linden, hazelnut, Scotch pine, oak and black pine, red pine); Mediterranean high mountain forests (oak, black pine, fir, cedar, juniper, beech-hornbeam).

FIGURE 8. *Ovis orien anatolicus (Aykut İnce)*

FIGURE 9. Camili Biosphere Reserve (Sıtkı Eraydın)

Irano-Turanian bio-geographical region: Central Anatolia steppe forests (mossy and white oak, black pine, juniper); Central Anatolia dry black pine, oak and juniperus forests; Eastern Anatolia dry oak forests. These rich forest ecosystems provide habitats for a great number of endemic plant species, important birds and mammal species and other wildlife elements. Most large mammals (bear, wild boar, fox, lynx and jackal) live in forest ecosystems, as do many of the mammals that are in danger of extinction (several species of deer).

Mountain Ecosystems Mountain systems are formed by folding, faulting and volcanism. The types of the mountain ecosystems vary by biogeographical regions, formation and altitudes.

The mountains of Aegean Region formed by faulting are perpendicular to the coast and they are rich in water resources, formed as a result of the Alpine-Himalayan folding and are important ecosystems for biological diversity with their high rates of endemism. The volcanic mountains that have special value to biological diversity

with their volcanic lake formations have a special importance for agro-biodiversity.

Inland Waters Ecosystems With its rivers and lakes covering an area of about 10000 km^2, Turkey has very important inland water resources. There are 135 wetlands of international significance (Figure 10) and 13 of them have been designated as Ramsar Sites (Figure 11).

FIGURE 10. *İğneada Longoz Forest National Park (Aykut İnce)*

FIGURE 11. Sultan Sazlığı National Park-Ramsar Site (Mustafa Yıldız)

Nine major rivers are more than 500 km in length. A highly complex geography of the country and separation of rivers by mountains from each other prevents the diffusion of species to a large extent, resulting in high endemism and genetic diversity. A great majority of the invertebrates living in river ecosystems are endemic. Two hundred thirty six fish taxa belonging to 26 families have been identified in inland aquatic ecosystems. Turkey is a key country for many bird species with nearly 460.

Coastal and Marine Ecosystems Different characteristics of the seas namely the Black Sea, the Marmara, the Aegean and the Eastern Mediterranean, have added much to the diverse biodiversity values. The Mediterranean, which has the highest salinity and temperature among the Turkish seas, is the area with the richest biodiversity. Black Sea is the largest enclosed sea of the world and the most isolated from oceans. The Turkish Straits Systems, consisting of Strait of Istanbul and Strait of Çanakkale and the Sea of Marmara, has the position of an inland sea system providing water transport system between the Sea of Aegean and the Black Sea. With a surface area of about 180000 km^2, the Aegean Sea has a very complicated bottom topography and coastal geometry. In addition, there are hundreds of islands. Coastal ecosystems are highly special ecosystems such as dunes, caves, deltas, lagoons, marshes and calcareous terraces.

PROTECTED AREAS IN TURKEY

Turkey has made progress in protecting nature and biodiversity rich areas. Since 1990, the extent of protected areas has almost doubled to reach 7.2% of the territory. About 1.2% of these areas are protected under IUCN categories I-II. Protected areas are managed under different laws and regulations by different governmental institutions (Table 2).

INTERNATIONAL CONVENTIONS AND PROTOCOLS RATIFIED BY TURKEY

1. Convention on Biodiversity (Rio Convention -1997)
2. Cartagena Protocol on Biosafety (2004)
3. Convention on the International Trade in Endangered Species of Wild Flora and Fauna (CITES Convention -1996)
4. Convention for the Protection and Development of the Marine Environment and Coastal Region of the Mediterranean Sea (Barcelona Convention - 1988)
5. Convention on the Protection of the Black Sea against Pollution (Bucharest Convention - 1994)
6. Protection of Cultural and National Heritage (1983)
7. Convention on Combating Erosion (1998)
8. European Landscape Convention (2000)
9. Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention - 1984)
10. Convention on Wetlands of International Importance, especially as Waterfowl Habitats (Ramsar Convention -1994)
11. Kyoto Protocol (2009)

CONCLUSION

The decline of biodiversity is the one of the most serious global environmental threats. Land conversion, illegal hunting, uncontrolled tourism, over grazing, pollution and waste and invasive species are the main threats to biodiversity conservation. All attempts to stop biodiversity loss should be increased and promoted throughout the world. For this purpose, threats and potential pressures on species, habitats and ecosystems must be promptly eliminated or reduced through providing balance between sustainable use and protection of natural resources. Different ecosystems mostly constitute a part of protected areas. Protected areas are important sites to conserve biodiversity and they contain vital functions for living

TABLE 2. Protected areas in Turkey

Protected Areas	Number	Related Law	Institution
National park	40	Law on National Parks	Ministry of Forestry and Water Affairs
Nature conservation area	31	Law on National Parks	Ministry of Forestry and Water Affairs
Natural monument	107	Law on National Parks	Ministry of Forestry and Water Affairs
Nature park	184	Law on National Parks	Ministry of Forestry and Water Affairs
Wildlife development areas	81	Law on Terrestrial Hunting	Ministry of Forestry and Water Affairs
Conservation forest	58	Law on Forest	Ministry of Forestry and Water Affairs
Genetic conservation areas	239	Law on Forest	Ministry of Forestry and Water Affairs
Seed stands	373	Law on Forest	Ministry of Forestry and Water Affairs
Specially protected areas (SPAs)	15	Law on Environment	Ministry of Environment and Urbanization
Natural sites	1273	Law on Conservation of Cultural and Natural Heritage	Ministry of Environment and Urbanization
Ramsar sites	14	Ramsar Convention by-law on Conservation of Wetlands	Ministry of Forestry and Water Affairs
Biosphere reserves	1	Law on National Parks-Law on Forest	Ministry of Forestry and Water Affairs

organisms. For providing sustainability of biodiversity, the number of protected areas must be increased.

The countries governing bodies must aware of its responsibility for environmental conservation. The damages brought to the environment threaten the existence of *Homo sapiens* globally. This issue necessitates that each country must conserve the environment by taking national and international measures. Turkey is one of the most important countries with its unique geographical position and remarkable biodiversity and is striving hard to fulfill its commitments under national and international conventions.

REFERENCES

Kiziroğlu, İ., Adıgüzel, Ö. & Bahadır, M. 2006. Nature reserves and biodiversity in Turkey and related policy measures along with joining the EU. *Fresenius Environmental Bulletin* 15(9b): 32-36.

Progress towards the European 2010 Biodiversity Target, EEA (European Environment Agency) Report, No: 4/2009.

The IUCN 2009-2012 Program, Shaping a Sustainable Future.

The Millennium Development Goals Report 2099, United Nations, New York 2009.

The National Biodiversity Strategy and Action Plan of Turkey, 2007.

The OECD Environmental Performance Reviews of Turkey, 2008.

The United Nations Millennium Declaration. 2000. 8th Plenary Meeting, 8 September.

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